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Nohales Herraiz et al.

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(54) **COMPRESSOR OIL MANAGEMENT SYSTEM**

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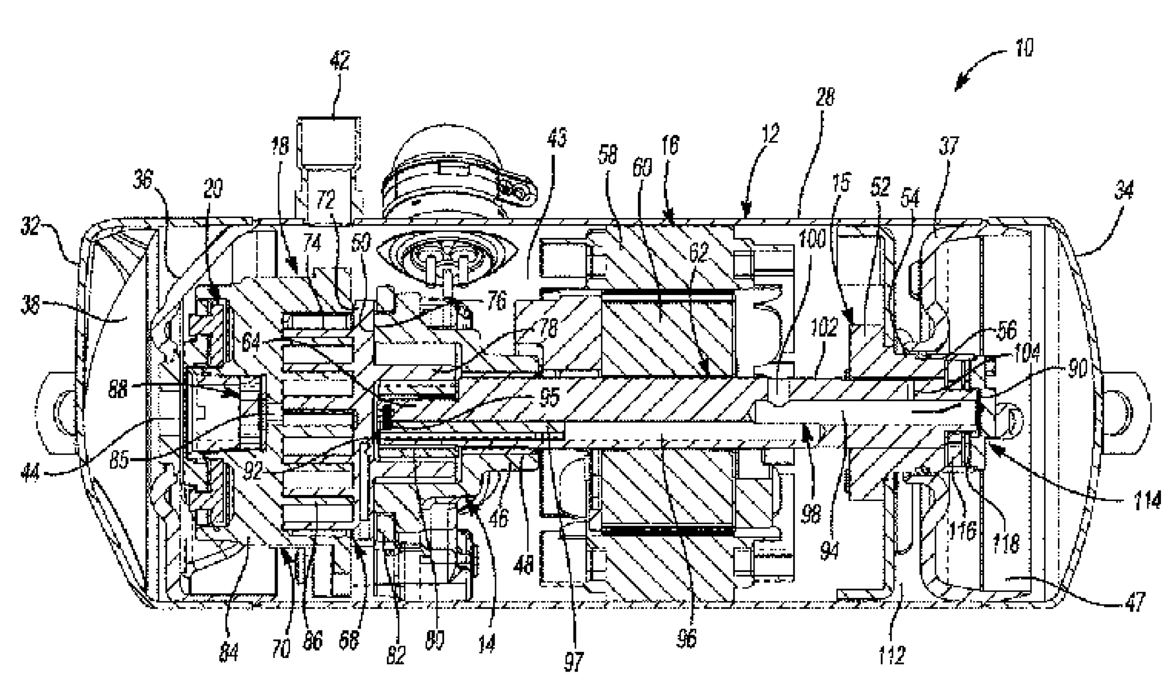
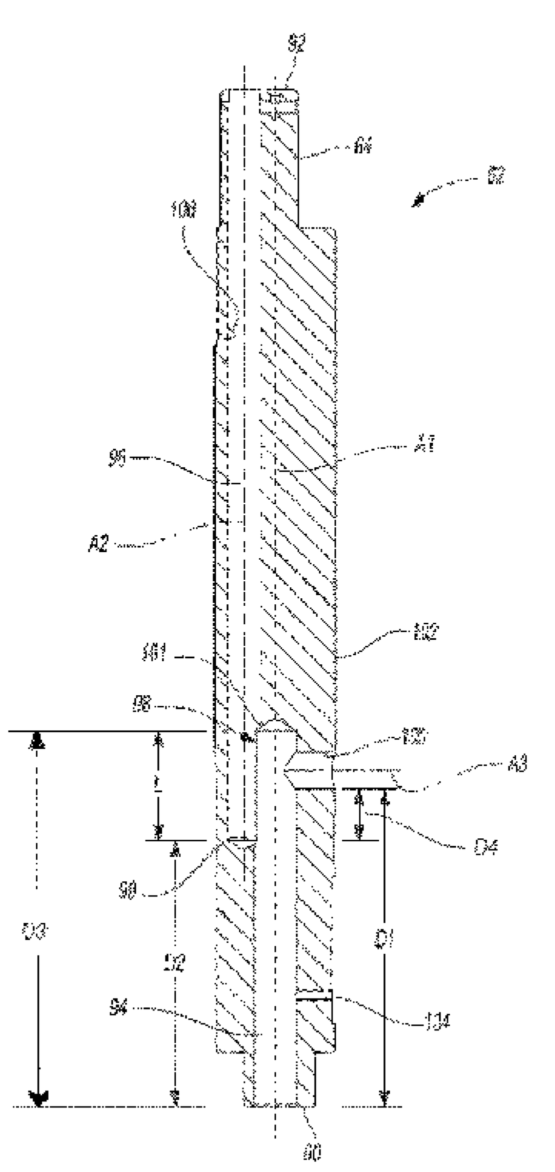
(57) **ABSTRACT**

A compressor includes a compression mechanism and a driveshaft that drives the compression mechanism. The driveshaft may include a first axially extending passage, a second axially extending passage, and a lubricant distribution passage. The first and second axially extending passages may be radially offset from each other and may intersect each other at an overlap region. The first and second axially extending passages are in fluid communication with each other at the overlap region. The lubricant distribution passage may extend from the first axially extending passage through an outer diametrical surface of the driveshaft. The lubricant distribution passage may be disposed at a first axial distance from a first axial end of the driveshaft. A first axial end of the overlap region may be disposed at a second axial distance from the first axial end of the driveshaft. The first axial distance may be greater than the second axial distance.

21 Claims, 4 Drawing Sheets





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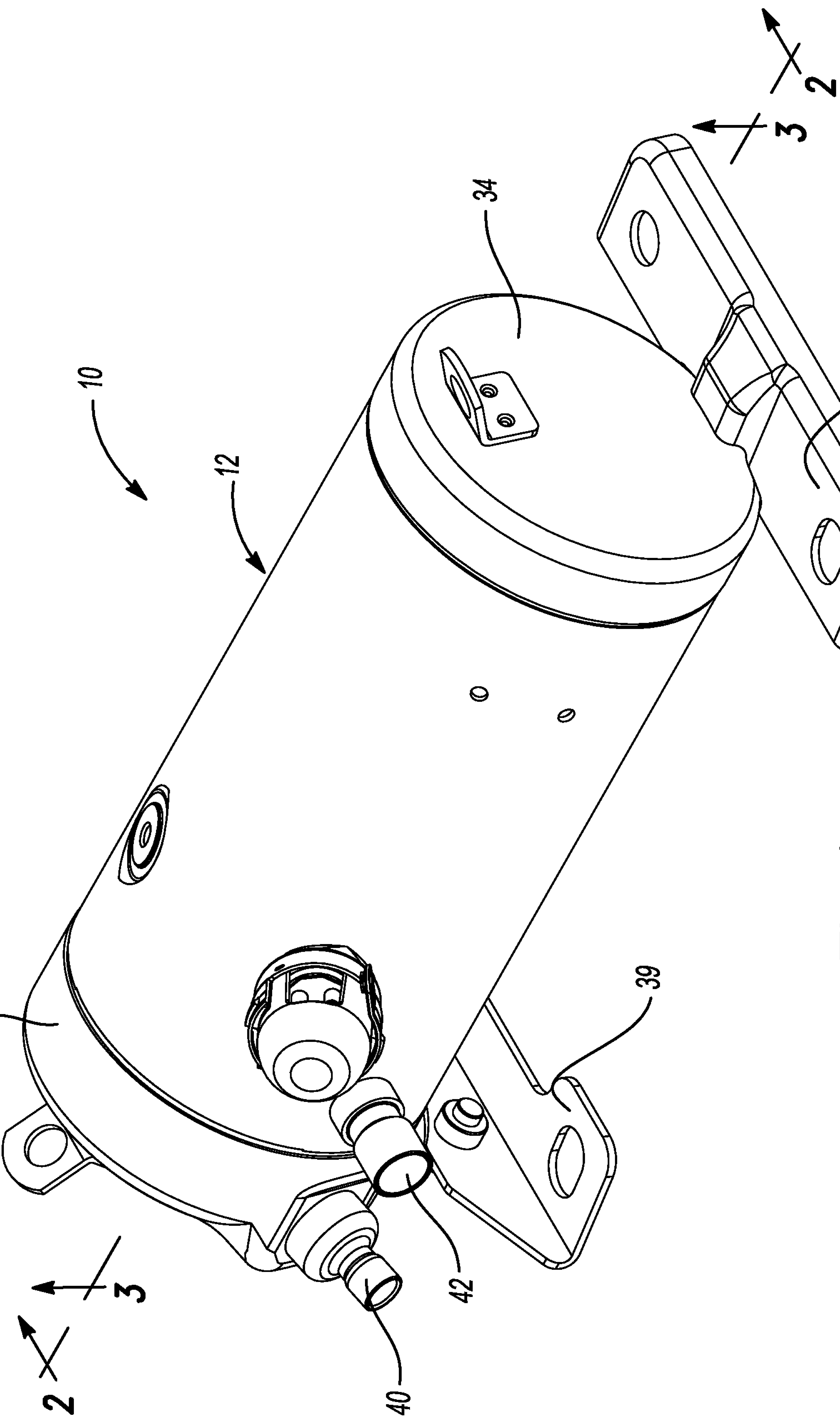

Fig-1

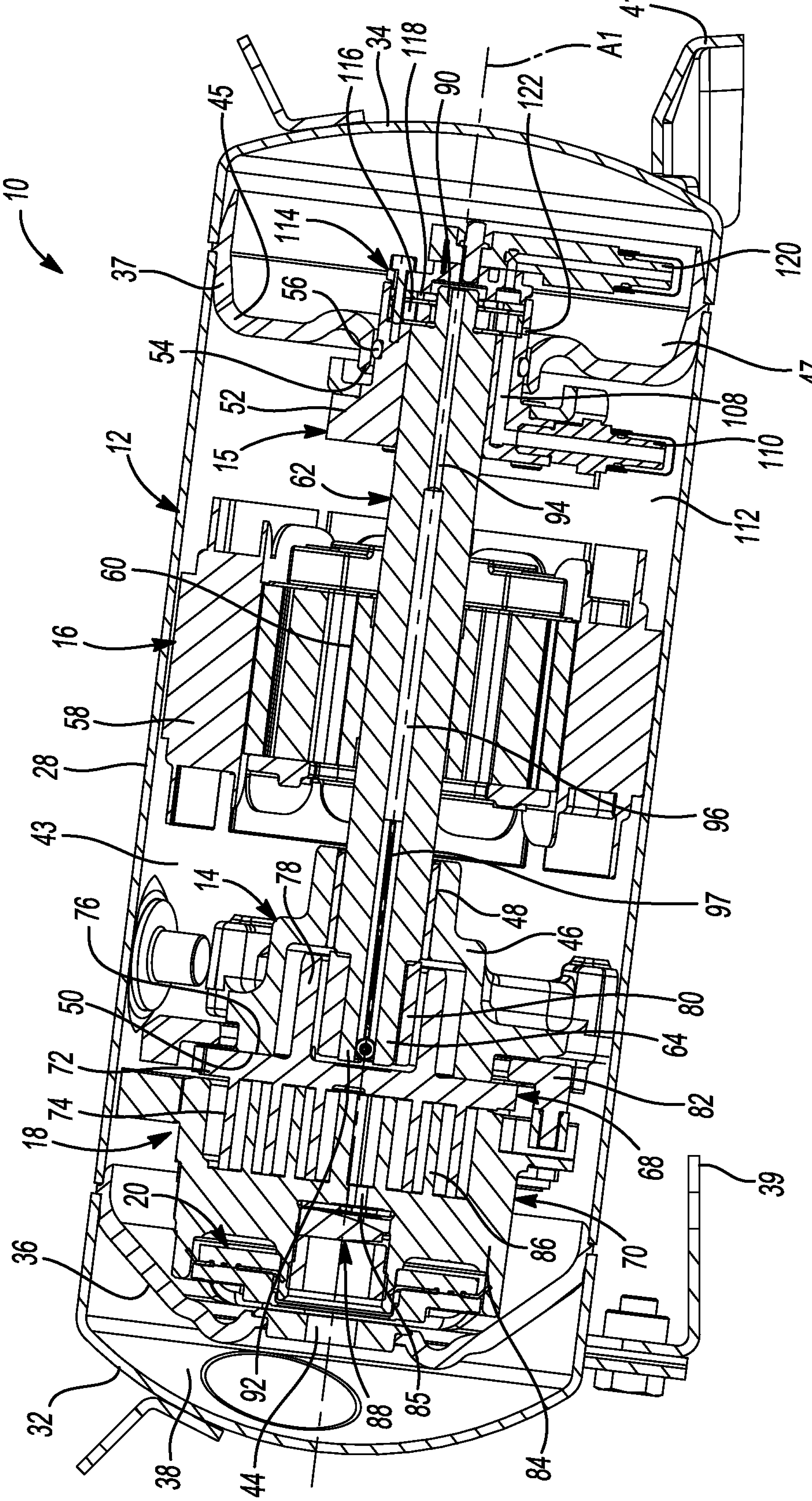
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Fig-2

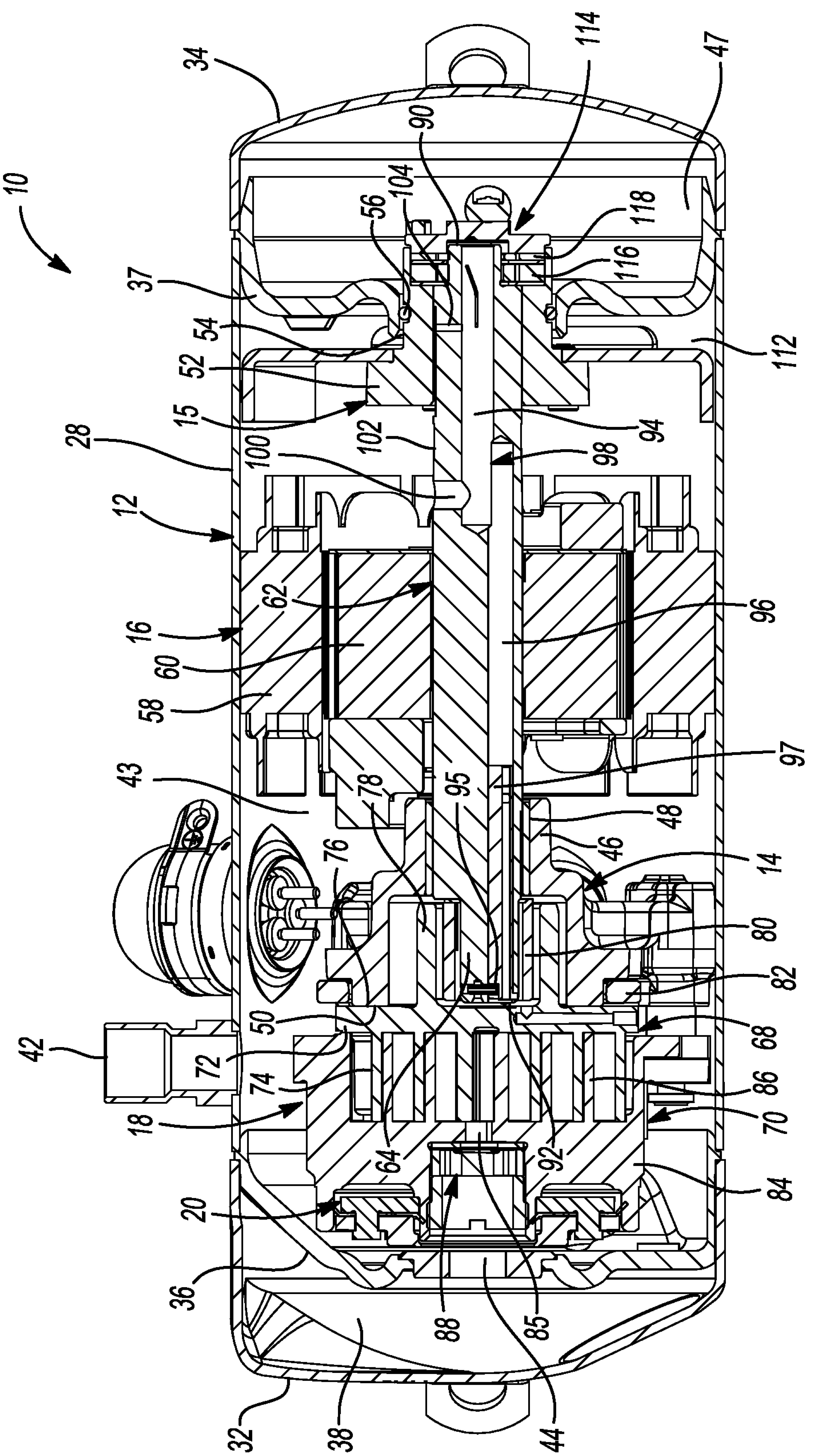
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Fig-3

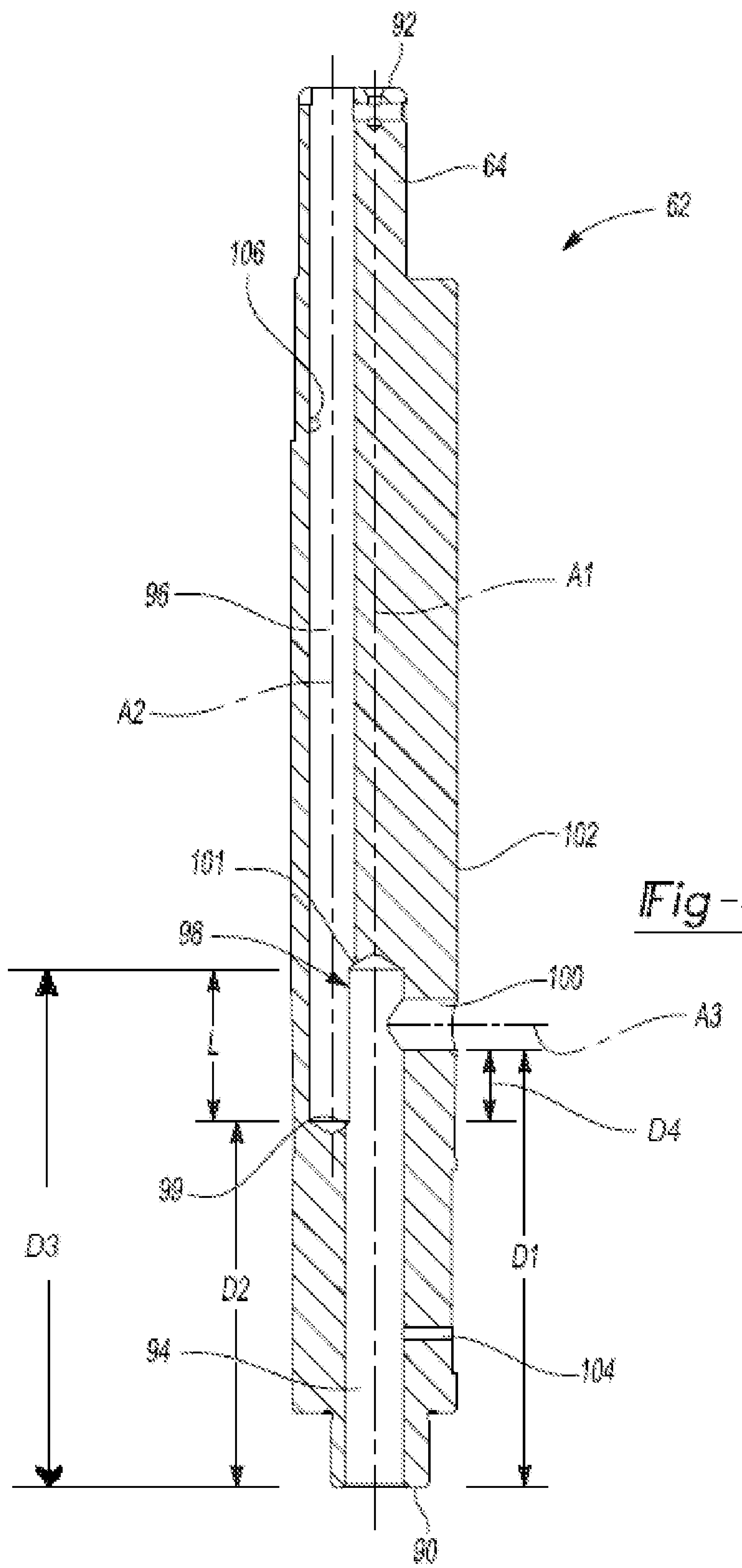

Fig-4

COMPRESSOR OIL MANAGEMENT SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is the U.S. National Phase Application under 35 U.S.C. 371 of International Application No. PCT/CN2018/108228 filed on Sep. 28, 2018. The entire disclosure of the application referenced above is incorporated herein by reference.

FIELD

The present disclosure relates to a compressor, and more particularly, to a compressor oil management system.

BACKGROUND

This section provides background information related to the present disclosure and is not necessarily prior art.

A climate-control system such as, for example, a heat-pump system, a refrigeration system, or an air conditioning system, may include a fluid circuit having an outdoor heat exchanger, an indoor heat exchanger, an expansion device disposed between the indoor and outdoor heat exchangers, and one or more compressors circulating a working fluid (e.g., refrigerant or carbon dioxide) between the indoor and outdoor heat exchangers. Efficient and reliable operation of the one or more compressors is desirable to ensure that the climate-control system in which the one or more compressors are installed is capable of effectively and efficiently providing a cooling and/or heating effect on demand. Efficient and effective lubricant distribution throughout the compressor reduces wear and cools internal components of the compressor.

SUMMARY

This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

The present disclosure provides a compressor that includes a compression mechanism and a driveshaft. The driveshaft drives the compression mechanism. The driveshaft may include a first axially extending passage, a second axially extending passage, and a lubricant distribution passage. The first axially extending passage and the second axially extending passage may be radially offset from each other and may intersect each other at an overlap region. The first and second axially extending passages are in fluid communication with each other at the overlap region. The lubricant distribution passage may extend from the first axially extending passage through an outer diametrical surface of the driveshaft. The lubricant distribution passage may be disposed at a first axial distance from a first axial end of the driveshaft. A first axial end of the overlap region may be disposed at a second axial distance from the first axial end of the driveshaft. The first axial distance may be greater than the second axial distance.

In some configurations of the compressor of the above paragraph, the first axially extending passage is a concentric passage extending through the first axial end of the driveshaft.

In some configurations of the compressor of either of the above paragraphs, a longitudinal axis of the second axially extending passage is radially offset from a rotational axis of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the second axially extending passage extends through a second axial end of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the longitudinal axis of the second axially extending passage is parallel to the rotational axis of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, a longitudinal axis of the lubricant distribution passage extends through the overlap region.

In some configurations of the compressor of any of the above paragraphs, the longitudinal axis of the lubricant distribution passage is perpendicular to a rotational axis of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the compressor includes a shell assembly, a bearing housing assembly, a first pump, and a second pump. The shell assembly may include a partition defining a primary oil sump and a secondary oil sump. The bearing housing assembly may support the driveshaft and extend through a central opening in the partition. The bearing housing assembly may include an oil-transferring passage that provides fluid communication between the secondary and primary oil sumps. The first pump may be attached to the driveshaft and may pump oil from the secondary oil sump to the primary oil sump via the oil-transferring passage. The second pump may be attached to the driveshaft and may pump oil from the primary oil sump into the first axially extending passage in the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the compression mechanism is a scroll-type compression mechanism.

In some configurations of the compressor of any of the above paragraphs, an axial length of the overlap region is at least 1.5 times larger than a diameter of the first axially extending passage.

In some configurations of the compressor of any of the above paragraphs, the lubricant distribution passage is disposed a fourth axial distance from the first axial end of the overlap region. The fourth axial distance may be at least half of the diameter of the first axially extending passage.

In some configurations of the compressor of any of the above paragraphs, the rotational axis of the driveshaft is positioned at an angle of 0-20 degrees relative to horizontal.

The present disclosure provides a compressor that includes a compression mechanism and a driveshaft. The driveshaft drives the compression mechanism. The driveshaft may include a first axially extending passage, a second axially extending passage, and a lubricant distribution passage. The first axially extending passage and the second axially extending passage may be radially offset from each other and may intersect each other at an overlap region. The first and second axially extending passages are in fluid communication with each other at the overlap region. The lubricant distribution passage may extend from the first axially extending passage through an outer diametrical surface of the driveshaft. The lubricant distribution passage may include an inlet disposed at the first axially extending passage and an outlet disposed at the outer diametrical surface of the driveshaft. The inlet of the lubricant distribution passage may be aligned in an axial direction with at least a portion of the overlap region. The axial direction is a direction extending along a rotational axis of the driveshaft.

In some configurations of the compressor of the above paragraph, the first axially extending passage is a concentric passage extending through a first axial end of the driveshaft.

In some configurations of the compressor of either of the above paragraphs, a longitudinal axis of the second axially extending passage is radially offset from the rotational axis of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the second axially extending passage extends through a second axial end of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the longitudinal axis of the second axially extending passage is parallel to the rotational axis of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, a longitudinal axis of the lubricant distribution passage extends through the overlap region.

In some configurations of the compressor of any of the above paragraphs, the longitudinal axis of the lubricant distribution passage is perpendicular to a rotational axis of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the compressor includes a shell assembly, a bearing housing assembly, a first pump, and a second pump. The shell assembly may include a partition defining a primary oil sump and a secondary oil sump. The bearing housing assembly may support the driveshaft and extend through a central opening in the partition. The bearing housing assembly may include an oil-transferring passage that provides fluid communication between the secondary and primary oil sumps. The first pump may be attached to the driveshaft and may pump oil from the secondary oil sump to the primary oil sump via the oil-transferring passage. The second pump may be attached to the driveshaft and may pump oil from the primary oil sump into the first axially extending passage in the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the compression mechanism is a scroll-type compression mechanism.

In some configurations of the compressor of any of the above paragraphs, an axial length of the overlap region is at least 1.5 times larger than a diameter of the first axially extending passage.

In some configurations of the compressor of any of the above paragraphs, the first axially extending passage extends through a first axial end of the driveshaft.

In some configurations of the compressor of any of the above paragraphs, the lubricant distribution passage is disposed an axial distance from the first axial end of the overlap region.

In some configurations of the compressor of any of the above paragraphs, the axial distance is at least half of the diameter of the first axially extending passage.

In some configurations of the compressor of any of the above paragraphs, the rotational axis of the driveshaft is positioned at an angle of 0-20 degrees relative to horizontal.

Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

FIG. **1** is a perspective view of a compressor according to the principles of the present disclosure;

FIG. **2** is a cross-sectional view of the compressor taken at a plane defined by line **2-2** of FIG. **1**;

FIG. **3** is a cross-sectional view of the compressor taken at a plane defined by line **3-3** of FIG. **1**; and

FIG. **4** is a cross-sectional view of a driveshaft of the compressor.

Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

Example embodiments will now be described more fully with reference to the accompanying drawings.

Example embodiments are provided so that this disclosure will be thorough, and will fully convey the scope to those who are skilled in the art. Numerous specific details are set forth such as examples of specific components, devices, and methods, to provide a thorough understanding of embodiments of the present disclosure. It will be apparent to those skilled in the art that specific details need not be employed, that example embodiments may be embodied in many different forms and that neither should be construed to limit the scope of the disclosure. In some example embodiments, well-known processes, well-known device structures, and well-known technologies are not described in detail.

The terminology used herein is for the purpose of describing particular example embodiments only and is not intended to be limiting. As used herein, the singular forms "a," "an," and "the" may be intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms "comprises," "comprising," "including," and "having," are inclusive and therefore specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The method steps, processes, and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed.

When an element or layer is referred to as being "on," "engaged to," "connected to," or "coupled to" another element or layer, it may be directly on, engaged, connected or coupled to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly engaged to," "directly connected to," or "directly coupled to" another element or layer, there may be no intervening elements or layers present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., "between" versus "directly between," "adjacent" versus "directly adjacent," etc.). As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

Although the terms first, second, third, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms may be only used to distinguish one element, component, region, layer or section from another region, layer or section. Terms such as "first," "second," and other numerical terms when used herein do not imply a sequence or order unless clearly indicated by the context. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the example embodiments.

Spatially relative terms, such as "inner," "outer," "beneath," "below," "lower," "above," "upper," and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. Spatially relative terms may be intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the example term "below" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

With reference to FIGS. **1**-**4**, a compressor **10** is provided that may include a hermetic shell assembly **12**, a first bearing housing assembly **14**, a second bearing housing assembly **15**, a motor assembly **16**, a compression mechanism **18**, and a floating seal assembly **20**. The shell assembly **12** may house the bearing housing assemblies **14**, **15**, the motor assembly **16**, the compression mechanism **18**, and the floating seal assembly **20**.

The shell assembly **12** forms a compressor housing and may include a cylindrical shell **28**, a first end cap **32** at the one end of the cylindrical shell **28**, a second end cap **34** at another end of the cylindrical shell **28**, a first transversely extending partition **36**, and a second transversely extending partition **37**. Mounting brackets or feet **39**, **41** may be attached to the first and second end caps **32**, **34** and may position the compressor **10** in a tilted configuration (i.e., so that a longitudinal axis of the cylindrical shell **28** is disposed at a non-zero, non-perpendicular angle relative to horizontal and relative to the direction of gravitational pull), as shown in FIG. **2**. In this manner, the second end cap **34** is vertically lower than the first end cap **32**. For example, the longitudinal axis of the cylindrical shell **28** is at approximately a seven degree angle relative to horizontal (e.g., so that gravity tends to pull oil toward the second end cap **34**). The longitudinal axis of the cylindrical shell **28** could be disposed at approximately 0-20 degrees relative to horizontal (i.e., 70-90 degrees relative to the direction of gravitational pull at the location where the compressor **10** is installed).

The first end cap **32** and the first partition **36** may generally define a discharge chamber **38**. The discharge chamber **38** may generally form a discharge muffler for compressor **10**. While the compressor **10** is illustrated as including the discharge chamber **38**, the present disclosure applies equally to direct discharge configurations. A discharge fitting **40** (FIG. **1**) may be attached to the shell assembly **12** at an opening in the first end cap **32**. A suction gas inlet fitting **42** (FIGS. **1** and **3**) may be attached to the shell assembly **12** at another opening. The suction gas inlet fitting **42** may be open to and in fluid communication with a suction chamber **43** defined by the cylindrical shell **28**, the first partition, and the second end cap **34**. The first partition **36** and the floating seal assembly **20** cooperate to separate the discharge chamber **38** from the suction chamber **43**. Suction-pressure working fluid within the suction chamber **43** may be drawn into the compression mechanism **18** during operation of the compressor **10**. The first partition **36** may include a discharge passage **44** therethrough providing communication between the compression mechanism **18** and the discharge chamber **38**.

The second partition **37** and the second end cap **34** may cooperate to define an oil sump **47** (e.g., a primary oil sump). The oil sump **47** may contain a volume of lubricant that may be pumped throughout the compressor **10**, as will be described in more detail below. The second partition **37** may include one or more vent openings **45** (FIG. **2**) to vent the space between the second partition **37** and the second end cap **34** to the suction chamber **43**.

The first bearing housing assembly **14** may be affixed to the shell **28** and may include a first bearing housing **46** and a first bearing **48** disposed therein. The first bearing housing **46** may house the bearing **48** therein and may define an annular flat thrust bearing surface **50** on an axial end surface thereof. The second bearing housing assembly **15** may be affixed to the shell **28** and may include a second bearing housing **52** and a second bearing (not shown) disposed therein. The second bearing housing **52** may extend through a central opening **54** in the second partition **37** (i.e., so that the second partition **37** surrounds a portion of the second bearing housing **52**. An annular seal **56** may sealingly engage the second partition **37** and the second bearing housing **52**.

The motor assembly **16** may be a variable-speed motor. The motor assembly **16** may include a motor stator **58**, a rotor **60**, and a driveshaft **62**. The motor stator **58** may be press fit into the shell **28**. The driveshaft **62** may be rotatably driven by the rotor **60** and may be rotatably supported by the bearing housing assemblies **14**, **15**. The rotor **60** may be press fit on the driveshaft **62**. The driveshaft **62** may include an eccentric crankpin **64**.

As described above, the cylindrical shell **28** is positioned in a horizontal or titled horizontal configuration. Therefore, a rotational axis **A1** of the driveshaft **62** may be at approximately a seven degree angle relative to horizontal (e.g., so that gravity tends to pull oil toward the second end cap **34**). The rotational axis **A1** of the driveshaft **62** could be disposed at approximately 0-20 degrees relative to horizontal (i.e., 70-90 degrees relative to the direction of gravitational pull at the location where the compressor **10** is installed).

The compression mechanism **18** may include a first scroll (e.g., an orbiting scroll **68**) and a second scroll (e.g., a non-orbiting scroll **70**). The orbiting scroll **68** may include an end plate **72** having a spiral wrap **74** on the upper surface thereof and an annular flat thrust surface **76** on the lower surface. The thrust surface **76** may interface with the annular flat thrust bearing surface **50** on the first bearing housing **46**. A cylindrical hub **78** may project downwardly from the thrust surface **76** and may have a drive bushing **80** rotatably disposed therein. The drive bushing **80** may include an inner bore in which the crank pin **64** is drivingly disposed. A flat surface of the crankpin **64** may drivingly engage a flat surface in a portion of the inner bore of the drive bushing **80** to provide a radially compliant driving arrangement. An Oldham coupling **82** may be engaged with the orbiting scroll **68** and either the non-orbiting scroll **70** or the first bearing housing **46** to prevent relative rotation between the scrolls **68**, **70**.

The non-orbiting scroll **70** may include an end plate **84** defining a discharge passage **85** and having a spiral wrap **86** extending from a first side thereof. The non-orbiting scroll **70** may be attached to the first bearing housing **46** via fasteners and sleeve guides that allow for a limited amount of axial movement of the non-orbiting scroll **70** relative to the orbiting scroll **68** and the first bearing housing **46**. The spiral wraps **74**, **86** may be meshingly engaged with one another and define compression pockets therebetween. A discharge valve assembly **88** may be disposed within or adjacent the discharge passage **85** to restrict or prevent fluid flow from the discharge chamber **38** back into the compression mechanism **18**.

Referring now to FIGS. **2**-**4**, the driveshaft **62** includes a first axial end **90** and a second axial end **92**. The crankpin **64** is disposed at the second axial end **92**. The driveshaft **62** may include a first axially extending passage **94** (i.e., a first passage that extends along or parallel to the rotational axis A**1** (FIG. **4**) of the driveshaft **62**) and a second axially extending passage **96** (i.e., a second passage that extends parallel to or generally alongside the rotational axis A**1** of the driveshaft **62**). The first axially extending passage **94** may be a concentric passage (e.g., a longitudinal axis of the first axially extending passage **94** may be collinear or approximately collinear with the rotational axis A**1** of the driveshaft **62**). The second axially extending passage **96** may be an eccentric passage (e.g., a longitudinal axis A**2** of the second axially extending passage **96** is radially offset from the rotational axis A**1** of the driveshaft **62**). In some configurations, the longitudinal axis A**2** of the second axially extending passage **96** is parallel to the rotational axis A**1** of the driveshaft **62**. In other configurations, the longitudinal axis A**2** of the second axially extending passage **96** may be angled relative to the rotational axis A**1** of the driveshaft.

In some configurations, an oil allocation insert **97** (FIGS. **2** and **3**) may be received within the second axially extending passage **96**. For example, a retention pin **95** and/or a fastener may fixedly retain the oil allocation insert **97** within the second axially extending passage **96**. The oil allocation insert **97** can be sized to partially restrict the flow of oil through the second axially extending passage **96** to achieve desired flow rates through the second axially extending passage **96**. In other configurations, the driveshaft **62** does not include the oil allocation insert **97**.

The first axially extending passage **94** may extend through the first axial end **90** of the driveshaft **62** and may extend through only a portion of the length of the driveshaft **62**. The second axially extending passage **96** may extend through the second axial end **92** of the driveshaft **62** and may extend through only another portion of the length of the driveshaft **62**. The first and second axially extending passages **94**, **96** overlap each other at an overlap region **98**. The overlap region **98** includes a portion of the length of the first axially extending passage **94** and a portion of the length of the second axially extending passage **96** that intersect each other and are open to each other to fluidly communicate with each other. In other words, the overlap region **98** is an opening through which fluid can flow from the first axially extending passage **94** to the second axially extending passage **96** (and from the second axially extending passage **96** to the first axially extending passage **94**).

The driveshaft **62** may also include a lubricant distribution passage **100** (FIGS. **3** and **4**). The lubricant distribution passage **100** may extend radially outward from the first axially extending passage **94** and through an outer diametrical surface **102** of the driveshaft **62**. As shown in FIG. **4**, a longitudinal axis A**3** of the lubricant distribution passage **100** may be perpendicular to the rotational axis A**1** of the driveshaft **62**. The longitudinal axis A**3** of the lubricant distribution passage **100** may extend through the overlap region **98**. As shown in FIG. **4**, the lubricant distribution passage **100** is positioned such that a first axial distance D**1** (i.e., a distance along the rotational axis A**1**) between the lubricant distribution passage **100** and the first axial end **90** of the driveshaft **62** is greater than a second axial distance D**2** (i.e., a distance along the rotational axis A**1**) between a first axial end **99** of the overlap region **98** and the first axial end **90** of the driveshaft **62**. As shown in FIG. **3**, the lubricant distribution passage **100** may be disposed between the second bearing housing **52** and the rotor **60** such that a flow of lubricant through the lubricant distribution passage **100** is not restricted by the second bearing housing **52** or the rotor **60**.

In some configurations, the entire lubricant distribution passage **100** is axially closer (closer in a direction along or parallel to the rotational axis A**1**) to the first axial end **90** of the driveshaft **62**. In other words, an axial distance between the first axial end **90** of the driveshaft **62** and a second axial end **101** of the overlap region **98** is greater than the sum of the first axial distance D**1** plus the diameter of the lubricant distribution passage **100**.

The driveshaft **62** may also include a first radially extending passage **104** and a second radially extending passage **106**. The first radially extending passage **104** may extend from the first axially extending passage **94** through the outer diametrical surface **102** of the driveshaft **62**. The first radially extending passage **104** may be disposed an axial distance (i.e., a distance along the rotational axis A**1**) from the first axial end **90** that is less than the second axial distance D**2**. As shown in FIG. **3**, the first radially extending passage **104** may be positioned to allow a portion of the lubricant in the first axially extending passage **94** to flow radially outward to the second bearing housing assembly **15** to lubricate the bearing of the second bearing housing assembly **15**.

The second radially extending passage **106** may extend from the second axially extending passage **96** through the outer diametrical surface **102** of the driveshaft **62**. The second radially extending passage **106** may be disposed an axial distance (i.e., a distance along the rotational axis A**1**) from the second axial end **92** that is less than an axial distance between the second axial end **92** and the overlap region **98**. The second radially extending passage **106** may be positioned to allow a portion of the lubricant in the second axially extending passage **96** to flow radially outward to the first bearing housing assembly **14** to lubricate the bearing **48** of the first bearing housing assembly **14**.

Referring now to FIG. **2**, the second bearing housing **52** may include an oil-transferring passage **108**. A first oil pickup fitting **110** may be attached to the second bearing housing **52** and may extend vertically downward (radially outward relative to the rotational axis A**1**) from the second bearing housing **52**. The first oil pickup fitting **110** may extend down into an oil collection area **112** (i.e., a secondary oil sump) that may be defined by the cylindrical shell **28** and the second partition **37**. The first oil pickup fitting **110** provides fluid communication between the oil collection area **112** and the oil-transferring passage **108**.

As shown in FIG. **2**, a pump assembly **114** may be mounted to second bearing housing **52** between the second partition **37** and the second end cap **34**. The pump assembly **114** may include a first pump **116**, a second pump **118**, and a second oil pickup fitting **120**. The first and second pumps **116**, **118** may each include a rotor (or impeller) disposed within a pump housing. The rotors of the first and second pumps **116**, **118** may be attached to the driveshaft **62** for rotational with the driveshaft **62**.

During rotation of the driveshaft **62**, the first pump **116** may draw oil from the oil collection area **112** into the first oil pickup fitting **110** and through the oil-transferring passage **108** and discharge the oil into the oil sump **47** via an outlet **122** in the second bearing housing **52**. In this manner, during rotation of the driveshaft **62**, the first pump **116** transfers oil from the oil collection area **112** to the oil sump **47**.

Furthermore, during rotation of the driveshaft **62**, the second pump **118** may draw oil from the oil sump **47** through the second oil pickup fitting **120** and force the oil into the first axially extending passage **94** in the driveshaft **62**. Some of the oil in the first axially extending passage **94** oil may flow through first radially extending passage **104** (FIGS. **3** and **4**) to lubricate the bearing in the second bearing housing assembly **15**; some of the oil in the first axially extending passage **94** may flow through the lubricant distribution passage **100** and back to the oil collection area **112**; and some of the oil in the first axially extending passage **94** may flow into the second axially extending passage **96**. Some of the oil in the second axially extending passage **96** may flow through the second radially extending passage **106** (FIG. **4**) to lubricate the bearing **48** in the first bearing housing assembly **14**; and some of the oil in the second axially extending passage **96** may flow all of the way through the second axially extending passage **96** (i.e., to the second axial end **92** of the driveshaft **62**) and flow into the hub **78** of the orbiting scroll **68** to lubricate the compression mechanism **18**.

As shown in FIG. **4**, the overlap region **98** has an axial length L (i.e., an axial distance between the first axial end **99** of the overlap region **98** and the second axial end **101** of the overlap region **98**). In some configurations, the axial length L of the overlap region **98** is 1.5 times (or more) larger than a diameter of the first axially extending passage **94**. The second axial end **101** of the overlap region **98** is disposed a third axial distance D**3** from the first axial end **99** of the driveshaft **62**. The lubricant distribution passage **100** is disposed a fourth axial distance D**4** (i.e., a difference between the first axial distance D**1** and the second axial distance D**2**) from the first axial end **99** of the overlap region. In some configurations, the fourth axial distance D**4** may be half (or more) of the diameter of the first axially extending passage **94**. In some configurations, the fourth axial distance D**4** may be approximately equal to the diameter of the first axially extending passage **94**. In some configurations, the diameter of the lubricant distribution passage **100** may be half (or more) of the diameter of the first axially extending passage **94**. In some configurations, the diameter of the lubricant distribution passage **100** may be about 0.8-1 times the diameter of the first axially extending passage **94**. In some configurations, the driveshaft **62** could include multiple relatively smaller lubricant distribution passages **100** instead of a single relatively larger lubricant distribution passage **100**.

The magnitudes of the axial length L, the fourth axial distance D**4**, and the diameter of the lubricant distribution passage **100** determine how much oil from the first axially extending passage **94** will flow into the second axially extending passage **96** and how much oil from the first axially extending passage **94** will flow through the lubricant distribution passage **100**.

Positioning the lubricant distribution passage **100** along the axial length L at the fourth axial distance D**4** improves oil management over the range of the compressor's motor speeds and maintains a relatively constant oil level (or at least an adequate oil level) in the oil sump **47** at all motor speeds. That is, by directing some of the oil from the first axially extending passage **94** through the lubricant distribution passage **100** instead of through the second axially extending passage **96**, an appropriate amount of oil can be returned directly back to the oil collection area **112** (rather than building up above the stator **58** or travelling into the compression mechanism **18**, becoming entrained in working fluid (refrigerant) and being discharged from the compressor) and then pumped (via the first pump **116**) back into the oil sump **47**.

While the compression mechanism **18** is described above as being a scroll-type compression mechanism, the principles of the present disclosure are applicable to other types of compression mechanisms. Therefore, in some configurations, the compression mechanism of the compressor **10** could be a reciprocating-type compression mechanism (e.g., including one or more pistons that reciprocate within one or more cylinders), a rotary-vane-type compression mechanism (e.g., including a rotor that rotates within a cylinder and a vane that reciprocates relative to the rotor and cylinder), or a rotary-screw-type compressor (e.g., having meshing helical screws), for example.

The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

What is claimed is:

1. A compressor comprising:

a compression mechanism;

a driveshaft driving the compression mechanism, wherein the driveshaft includes a first axial end and a second axial end, wherein the driveshaft includes an eccentric crankpin defining the second axial end, and wherein the driveshaft includes a first axially extending passage, a second axially extending passage, and a lubricant distribution passage;

a first bearing housing supporting the driveshaft;

a second bearing housing supporting the driveshaft; and

a motor assembly disposed between the first bearing housing and the second bearing housing,

wherein:

the first axially extending passage extends through the first axial end of the driveshaft,

the second axially extending passage extends through the second axial end of the driveshaft,

the first axially extending passage and the second axially extending passage are radially offset from each other and intersect each other at an overlap region,

the first and second axially extending passages are in fluid communication with each other at the overlap region,

the lubricant distribution passage extends from the first axially extending passage through an outer diametrical surface of the driveshaft,

the lubricant distribution passage is disposed at a first axial distance from the first axial end of the driveshaft, a first axial end of the overlap region is disposed at a second axial distance from the first axial end of the driveshaft,

a second axial end of the overlap region is disposed a third axial distance from the first axial end of the driveshaft, the first axial distance is greater than the second axial distance and less than the third axial distance, an inlet of the lubricant distribution passage and an outlet of the lubrication passage are axially closer to the first axial end of the driveshaft than third axial distance and axially further from the first axial end of the driveshaft second axial distance, and

an outlet of the lubricant distribution passage provides lubricant directly to a portion of the motor assembly.

2. The compressor of claim **1**, wherein a rotational axis of the driveshaft extends along and through the first axially extending passage.

3. The compressor of claim **2**, wherein a longitudinal axis of the second axially extending passage is radially offset from the rotational axis of the driveshaft.

4. The compressor of claim **3**, wherein the longitudinal axis of the second axially extending passage is parallel to the rotational axis of the driveshaft.

5. The compressor of claim **3**, wherein a longitudinal axis of the lubricant distribution passage extends through the overlap region.

6. The compressor of claim **5**, wherein the longitudinal axis of the lubricant distribution passage is perpendicular to the rotational axis of the driveshaft.

7. The compressor of claim **1**, further comprising:

a shell assembly including a partition defining a primary oil sump and a secondary oil sump, wherein the second bearing housing extends through a central opening in the partition, and wherein the second bearing housing includes an oil-transferring passage that provides fluid communication between the secondary and primary oil sumps;

a first pump attached to the driveshaft and pumping oil from the secondary oil sump to the primary oil sump via the oil-transferring passage; and

a second pump attached to the driveshaft and pumping oil from the primary oil sump into the first axially extending passage in the driveshaft.

8. The compressor of claim **1**, wherein the compression mechanism is a scroll-type compression mechanism.

9. A compressor comprising:

a compression mechanism; and

a driveshaft driving the compression mechanism, wherein the driveshaft includes a first axial end and a second axial end, wherein the driveshaft includes an eccentric crankpin defining the second axial end, and wherein the driveshaft includes a first axially extending passage, a second axially extending passage, and a lubricant distribution passage, wherein:

the first axially extending passage extends through the first axial end of the driveshaft,

the second axially extending passage extends through the second axial end of the driveshaft,

the first axially extending passage and the second axially extending passge are radially offset from each other and intersect each other at an overlap region,

the first and second axially extending passages are in fluid communication with each other at the overlap region,

the lubricant distribution passage extends from the first axially extending passage through an outer diametrical surface of the driveshaft,

the lubricant distribution passage is disposed at a first axial distance from the first axial end of the driveshaft,

a first axial end of the overlap region is disposed at a second axial distance from the first axial end of the driveshaft,

a second axial end of the overlap region is disposed a third axial distance from the first axial end of the driveshaft,

the first axial distance is greater than the second axial distance and less than the third axial distance, and

an axial length of the overlap region is at least 1.5 times larger than a diameter of the first axially extending passage.

10. The compressor of claim **9**, wherein the lubricant distribution passage is disposed a fourth axial distance from the first axial end of the overlap region, and wherein the fourth axial distance is at least half of the diameter of the first axially extending passage,

wherein the compressor includes a first bearing housing supporting the driveshaft and a second bearing housing supporting the driveshaft, and

wherein an inlet of the lubricant distribution passage and an outlet of the lubricant distribution passage are axially closer to the first axial end of the driveshaft than the third axial distance and axially further from the first axial end of the driveshaft than the second axial distance, and

the outlet of the lubricant distribution passage is disposed axially between the first bearing housing and the second bearing housing.

11. A compressor comprising:

a compression mechanism; and

a driveshaft driving the compression mechanism, wherein the driveshaft includes a first axial end and a second axial end, wherein the driveshaft includes an eccentric crankpin defining the second axial end, and wherein the driveshaft includes a first axially extending passage, a second axially extending passage, and a lubricant distribution passage;

a first bearing housing supporting the driveshaft;

a second bearing housing supporting the driveshaft; and

a motor assembly disposed between the first bearing housing and the second bearing housing,

wherein:

the first axially extending passage extends through the first axial end of the driveshaft,

the second axially extending passage extends through the second axial end of the driveshaft,

the first axially extending passage and the second axially extending passage are radially offset from each other and intersect each other at an overlap region,

the lubricant distribution passage includes an inlet disposed at the first axially extending passage and an outlet disposed at an outer diametrical surface of the driveshaft,

the inlet of the lubricant distribution passage is aligned in an axial direction with at least a portion of the overlap region,

the axial direction is a direction extending along a rotational axis of the driveshaft, and

the outlet of the lubricant distribution passage provides lubricant directly to a portion of the motor assembly.

12. The compressor of claim **11**, wherein the rotational axis of the driveshaft extends along and through the first axially extending passage.

13. The compressor of claim **12**, wherein a longitudinal axis of the second axially extending passage is radially offset from the rotational axis of the driveshaft.

14. The compressor of claim **13**, wherein the longitudinal axis of the second axially extending passage is parallel to the rotational axis of the driveshaft.

15. The compressor of claim **13**, wherein a longitudinal axis of the lubricant distribution passage extends through the overlap region.

16. The compressor of claim **15**, wherein the longitudinal axis of the lubricant distribution passage is perpendicular to a rotational axis of the driveshaft.

17. The compressor of claim **11**, further comprising:

a shell assembly including a partition defining a primary oil sump and a secondary oil sump, wherein the second bearing housing extends through a central opening in the partition, and wherein the second bearing housing includes an oil-transferring passage that provides fluid communication between the secondary and primary oil sumps;

a first pump attached to the driveshaft and pumping oil from the secondary oil sump to the primary oil sump via the oil-transferring passage; and

a second pump attached to the driveshaft and pumping oil from the primary oil sump into the first axially extending passage in the driveshaft.

18. The compressor of claim **11**, wherein the compression mechanism is a scroll-type compression mechanism.

19. The compressor of claim **11**, wherein the rotational axis of the driveshaft is positioned at an angle of 0-20 degrees relative to horizontal.

20. A compressor comprising:

a compression mechanism; and

a driveshaft driving the compression mechanism, wherein the driveshaft includes a first axial end and a second axial end, wherein the driveshaft includes an eccentric crankpin defining the second axial end, and wherein the driveshaft includes a first axially extending passage, a second axially extending passage, and a lubricant distribution passage, wherein:

the first axially extending passage extends through the first axial end of the driveshaft,

the second axially extending passage extends through the second axial end of the driveshaft,

the first axially extending passage and the second axially extending passge are radially offset from each other and intersect each other at an overlap region,

the lubricant distribution passage includes an inlet disposed at the first axially extending passage and an outlet disposed at an outer diametrical surface of the driveshaft,

the inlet of the lubricant distribution passage is aligned in an axial direction with at least a portion of the overlap region,

the axial direction is a direction extending along a rotational axis of the driveshaft, and

an axial length of the overlap region is at least 1.5 times larger than a diameter of the first axially extending passage.

21. The compressor of claim **20**, wherein the lubricant distribution passage is disposed an axial distance from the first axial end of the overlap region, and wherein the axial distance is at least half of the diameter of the first axially extending passage.

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